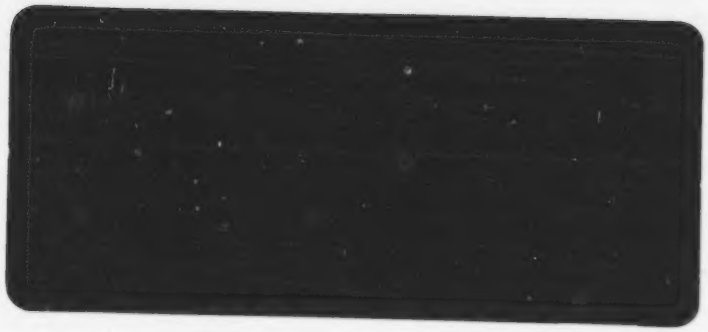

# THE CLEAN ENVIRONMENT COMMISSION

Manitoba
Environment

MG 912

# MEADOW MATERIALS
# (DOW CORNING SILICON ENERGY SYSTEMS, INC.)
# PILOT PLANT

REPORT OF THE HEARING BY
THE MANITOBA CLEAN ENVIRONMENT COMMISSION
JULY 31, 1990

# MEADOW MATERIALS
# (DOW CORNING SILICON ENERGY SYSTEMS, INC.)
# PILOT PLANT

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## BACKGROUND

Meadow Materials, a branch of Dow Corning Silicon Energy Systems Inc., which is wholly owned by the Dow Corning Corporation of Midland, Michigan, have proposed the construction of a pilot plant in East Selkirk for the production of silicon. The proposed plant has been designed as a research and development facility for the development of workable technical and economic parameters for future silicon metal production. The overall objective of the project is to develop a system of silicon production which lowers production costs; improves the overall efficiency of the manufacturing process; utilizes the by-products of production; and reduces the amount of waste generated by the process. If these objectives are achieved, it is forecast that the production of silicon in North America will become competitive on a global scale.

The proposed pilot plant is the second stage in the Silicon Products Commercial Development Program (SPCDP) which could ultimately lead to the commercial development of silicon production facilities in Manitoba. The SPCDP is a joint undertaking of the Dow Corning Corporation and the Manitoba Energy Authority with financial assistance provided by the federal Western Diversification Program. The SPCDP is premised on the Province's extensive resources of high quality silica sand and hydro-electric power.

Stage 1 of the SPCDP involved test production of silicon utilizing Black Island silica sand as a raw material in a 0.2 Mega-Watt (MW) closed plasma furnace in Austria. The favourable results from the stage 1 testing prompted the application for the Meadow Materials licence for the East Selkirk pilot plant proposal. The stage 2 proposal will involve the construction and operation of a 6 MW closed plasma furnace for the purpose of further research.

Development of the Meadow Materials proposed plant is subject to licensing requirements under the Manitoba Environment Act. In addition, the proposal must meet district and municipal land use planning and zoning requirements as administered under the Manitoba Planning Act.

The proponent convened public open houses in East Selkirk in June and November of 1989 with approximately 100 people in attendance at each. The conditional land use application was also subject to a public hearing.

The proposed plant site is located approximately 1.5 km east of the Provincial Road, PR, 204 bridge into the Town of Selkirk, Manitoba (Figure 1). The specific site is in the northeast quadrant of the PR 204 intersection with PR 212. (Figure 2). The proposed site is zoned for industrial use and is currently occupied in part by the Manitoba Hydro Selkirk Generating Station. The site required development approval, as a conditional use area, under the R.M. of St. Clements Planning Scheme (now administered under the R.M. Of St. Clements zoning By-law). Approval of the Conditional Use Permit was made on May 29, 1989, contingent on subsequent provincial government approvals.

The site was chosen because of relative advantages over other sites including the availability of suitable electric power, rail access, and related cost advantages. Some additional cost and convenience benefits arise from the ability of Meadow Materials to lease the land and certain facilities from Manitoba Hydro. Another attractive feature of the site, over others considered, was the greater effective separation of the site from potentially sensitive land use and environmental features.

The proposed pilot facility is regarded as a short duration facility for the purpose of research. Any future, and more permanent, commercial silicon production development would involve a more extensive site selection study. Such a future development would also require consideration of a more comprehensive assessment of a broader range of environmental impacts and planning factors under a new licence application. Given the proposed plant's research nature, the siting factors used in the selection of the pilot facility location would likely not be relevant in the selection of a long term commercial application. In any case, a new licence would have to be applied for in the event of future expansion of the proposed facility.

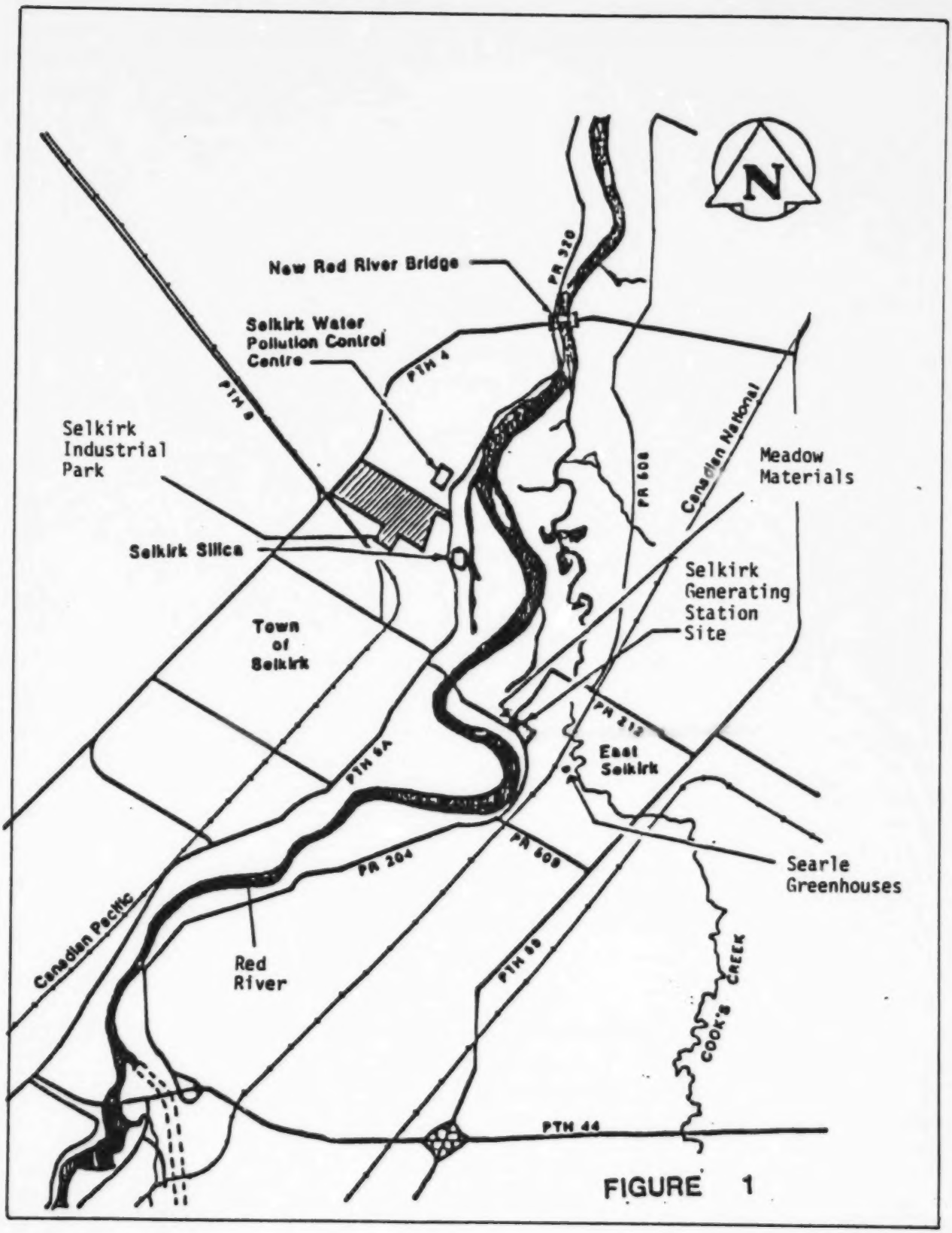
N
New Red River Bridge
PR 320
Selkirk Water Pollution Control Centre
PTH 4
PTH 9
Selkirk Industrial Park
Selkirk Silica
Town of Selkirk
PR 508
Canadian National
Meadow Materials
Selkirk Generating Station Site
PR 212
East Selkirk
PTH 59A
PR 204
PR 509
Searle Greenhouses
Canadian Pacific
Red River
PTH 59
COOK'S CREEK
PTH 44

FIGURE 1

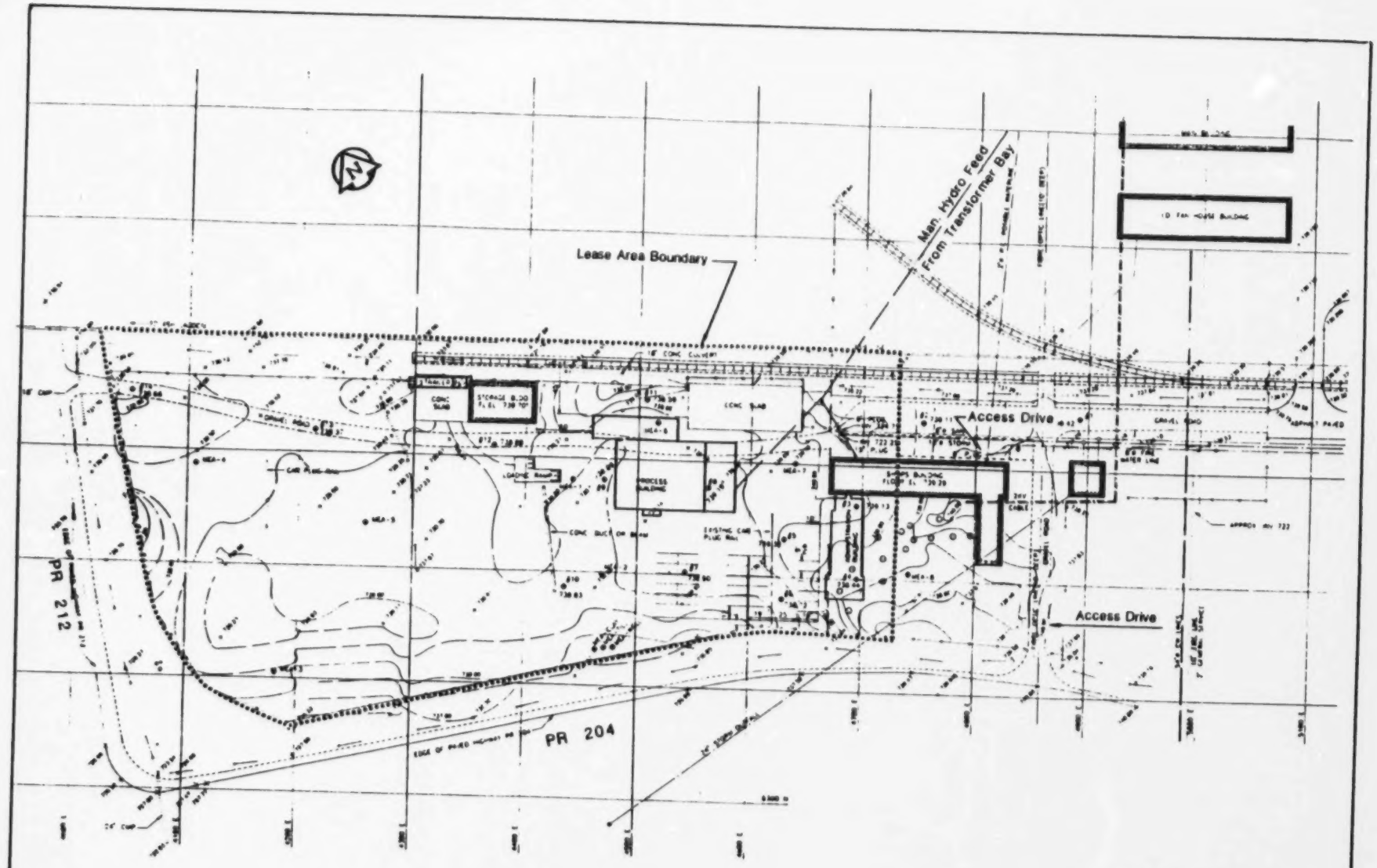


FIGURE 2
Pilot Plant Lease Area

The proposed Meadow Materials site was formerly used by Manitoba Hydro as a regional services centre. The Manitoba Hydro land encompasses the Meadow Materials site and the Selkirk Generating Station, which currently operates on a standby basis. The Manitoba Hydro land has been zoned as an industrial property and has been in use as such since 1960. The proposed plant will, therefore, be consistent with current land use as well as the historical land use of the past 30 years.

## Introduction

On September 28, 1989 Meadow Materials, a branch of DOW Corning Silicon Energy Systems, filed a proposal for licensing under the Manitoba Environment Act to construct and operate a pilot plant for the production of silicon metal in the community of East Selkirk. The plant is intended for the development of workable technical and economic parameters for commercial silicon production. The life of the operation is expected to be 2 years, however, this period could be extended by several more years.

After a summary of the proposal submitted by Meadow Materials was advertised and distributed to the interested public, as required under Environment Act regulations, a number of responses from the public were received by the Environment Department. Accordingly, the Honourable J. Glen Cummings, Minister of the Environment, in a letter dated May 4, 1990, requested the Clean Environment Commission to hold a public hearing on the Meadow Materials licence application. Upon conclusion of the hearing the Clean Environment Commission would provide the Minister with a report and recommendations with regard to the licensing of the proposal.

After receiving final environmental impact assessment material from the Environment Department on June 21, 1990, a public hearing was convened by the Clean Environment Commission on July 31, 1990 at 7.00 p.m. in East Selkirk, Manitoba. Members of the Commission in attendance at the hearing were: Mr. Stan Eagleton, Chairperson; Mr. J. Arnold Barr; Ms. Linda Ericsson; Mr. Ed Gramiak, and Ms. Donna Plant. Approximately 35 members of the public were in attendance at the hearing.

**THE PROPOSAL**

Mr. Arvid Arvidson, Plant Manager of Meadow Materials, presented the proposal for the construction of a pilot plant for the production of silicon metal in the community of East Selkirk, Manitoba. The plant would be constructed and operated under the name of Meadow Materials, a branch of Dow Corning Silicon Energy Systems. The silicon pilot plant would be a research facility with the prime objective of the development of workable technical and economic parameters for commercial silicon production. The project would be operated with funding, in part, supplied by the Western Economic Diversification program in the form of a repayable loan.

The proposed site of the facility is located on land which has been leased from Manitoba Hydro. Manitoba Hydro currently operates a coal-fired electric power generating station on a portion of the overall site. Meadow Materials has leased 2 hectares (5 acres) of land which is currently idle with the exception of railway spurs which terminate on the property. A conditional use permit was required from the R.M. of St. Clements for the use of the land, and this has been obtained contingent upon subsequent government approval.

Proposed development on the land would include the installation of a silicon products research and development facility; associated support facilities; office and shop complexes. Part of the office and shop services would be housed in buildings currently on the leased land and covered in the leasing agreement. Other potential buildings would include a processing plant, a warehouse, and storage facilities to house a variety of supplies and equipment.

The main feature of the silicon production facility (Figure 3) would be the operation of a 6 MW closed plasma electric furnace. The furnace would incorporate the new concept of an enclosed process system utilizing a carbon electrode capable of generating temperatures of 5000 degrees Celsius needed for the reduction of silica by carbon. The carbon would likely be in the form of high purity coal, coke or charcoal, with wood being another potential

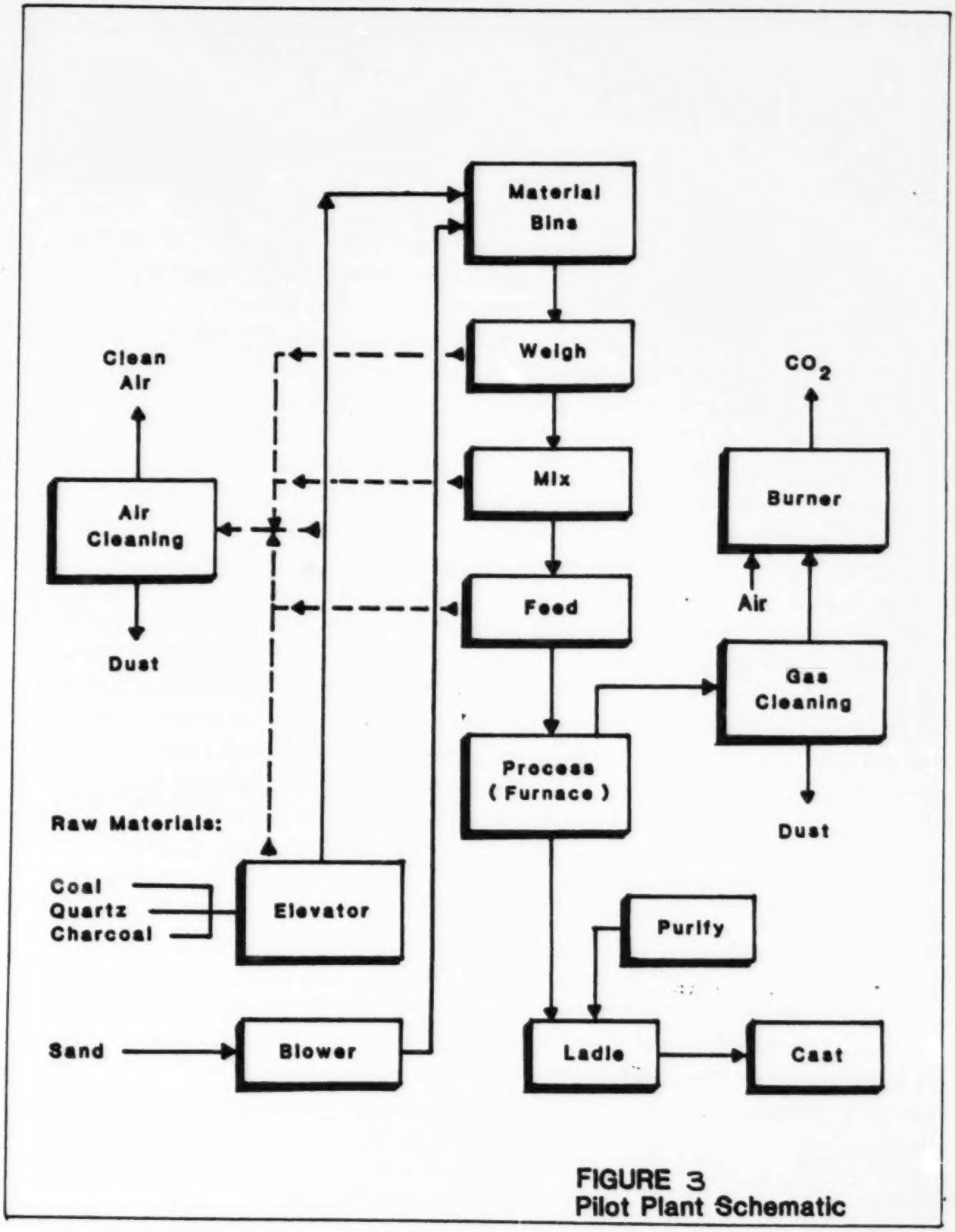


**FIGURE 3**
**Pilot Plant Schematic**

carbon source. The silicon product produced by the reduction reaction would be tapped to a ladle where it would be purified by oxidation, using an oxygen gas blowing operation. After purification the silicon product would be cast and allowed to solidify. For shipment, the silicon casts would be crushed to facilitate transport.

By-product gases, primarily carbon monoxide, would be cleaned to remove suspended solids prior to combustion in a flame stack. The combustion product, carbon dioxide, would be vented to the atmosphere. The initial gas product, carbon monoxide, is a potentially marketable product and in a full-scale operation would be stored and shipped to a suitable market. The pilot facility production of such product gas would not be sufficient to warrant the pursuit of a market. The conversion of carbon monoxide to carbon dioxide by the combustion operation provides for disposal of the waste product in a manner which will meet Manitoba Objectives and Guidelines for Air Pollutants.

Raw materials would be received by rail and truck and stored on the site in enclosed storage facilities. Exhaust and filtration equipment have been incorporated into the design of material handling systems to capture fugitive particles resulting from material handling. Similar exhaust and filtration systems would be employed in end-product handling to ensure that suspended particles are kept to within acceptable standards.

Water services, both domestic and cooling, would be obtained from ground water sources. Cooling water would be utilized in a closed loop system. The system would be cooled by a water spray during the summer. Some blowdown would be required from this spray system which would be discharged through an existing Manitoba Hydro storm sewer to the Red River. Sanitary waste water, showers and sink water, would be stored on site in storage tanks. This waste water would be removed periodically for treatment at the Town of Selkirk Water Pollution Control Plant. Wastewater collection and handling would meet or exceed Manitoba Surface Water Quality Objectives, ensuring that discharge water would not adversely affect the receiving stream to a significant degree.

**Air Emissions**

Mr. Arvidson explained that because the proposed pilot plant is a research and development facility, and due to the developmental nature of the process, it is necessary to state rates of operation and raw material consumption in general terms. It is therefore not possible to accurately forecast the quantity of emissions, or specific process by-products, within the full range of the pilot plant operation. This limitation was overcome by using worst case conditions in the preparation of the Environmental Impact Assessment.

In his anaylsis, Mr. Arvidson presented emission impact data predicted through the use of computer modeling of process parameters and ambient atmospheric conditions surrounding the proposed site. The environmental acceptability of predicted worst case emissions were based upon the current Objectives and Guidelines for Various Air Pollutants, (Ambient Air Criteria), as developed by the Manitoba Department of the Environment. Specific contaminants released from the process include sulfur dioxide, nitrogen dioxide, carbon monoxide, and suspended particulate matter.

For the purposes of comparisons, worst case levels of predicted emissions from the operation are compared with the corresponding Manitoba Objectives For Various Air Pollutants. (Tables 1, 2, 3, and 4.)

The production of by-product gases would be low due to the closed furnace design which allows for the precise regulation of the production process. The main by-product gases, carbon monoxide, sulfur dioxide, and nitrogen dioxide are predicted to be below the "Desirable" and "Acceptable" Manitoba guideline concentration levels in all cases. Given that the predicted values are calculated using the worst case senario of emissions, the actual pilot plant output would be expected to be at levels lower than these estimated levels.

Table 1

DISPERSED SULFUR DIOXIDE CONCENTRATION

| Time Period | Basis | Maximum Concentration Micrograms/Cubic Meter | |
|---|---|---|---|
| | | Vent Only | With Background |
| 1 Hour | Predicted | 59 | 171 |
| | Desirable | 450 | 450 |
| | Winnipeg (Max.) | | 159 |
| 8 Hour | Predicted | 31 | |
| 24 Hour | Predicted | 18 | 36 |
| | Desirable | 150 | 150 |
| Annual | Desirable | | 30 |

Table 2

DISPERSED NITROGEN DIOXIDE CONCENTRATION

| Time Period | Basis | Maximum Concentration Micrograms/Cubic Meter | |
|---|---|---|---|
| | | Vent Only | With Background |
| 1 Hour | Predicted | 8 | 112 |
| | Desirable | N/A | N/A |
| | Acceptable | 400 | 400 |
| | Winnipeg (Max.) | | 173 |
| 8 Hour | Predicted | | 4 |
| 24 Hour | Predicted | 2 | 19 |
| | Desirable | N/A | N/A |
| | Acceptable | 200 | 200 |
| Annual | Desirable | 60 | |

Table 3.

DISPERSED CARBON MONOXIDE CONCENTRATION
Non-typical Emergency Venting - Expected Duration Less Than 15 Minutes

| Time Period | Basis | Maximum Concentration Milligrams/Cubic Meter Vent Only |
|---|---|---|
| 1 Hour | Predicted | 27 |
| | Desirable | 15 |
| | Acceptable | 35 |
| | Winnipeg (Max.) | 15 |
| 8 Hour | Predicted | 7 |
| | Desirable | 7 |
| | Acceptable | 15 |
| 24 Hour | Predicted | 4 |

Table 4.

Suspended Solids Concentration

| Time Period | Basis | Maximum Concentration Micrograms/Cubic Meter Vent Only | With Background |
|---|---|---|---|
| 1 Hour | Predicted | 97 | |
| 8 Hour | Predicted | 52 | |
| 24 Hour | Predicted | 30 | 52 |
| | Acceptable | 120 | 120 |

The only occasion when Air Quality Objectives might be exceeded would be in the case of carbon monoxide vented during a theoretical and non-typical emergency venting requirement. At the time of such an emergency venting occurrence, the levels of carbon monoxide, (Table 3), were predicted to be above the Manitoba objective "Desirable" level only during the one hour time period. However, the concentration level was not expected to be above the "Acceptable" level. Non-typical venting would occur only in an emergency situation with an expected duration of less than 15 minutes.

On all other occasions, under normal operating conditions, carbon monoxide would be converted to carbon dioxide, and "Desirable" level concentrations of carbon monoxide would not be exceeded.

The emission of suspended particulate matter has also been predicted using worst case emission conditions. As shown in Table 4, the predicted emission levels of this material do not exceed the 24 hour "Acceptable" levels.

In addition to the predicted air borne emissions from the Meadow Materials operation, the combined effect of emissions from the proposed silicon plant operation together with emissions from the Selkirk Generating Station were analyzed. In the case of all of the contaminants of concern, the predicted combined concentration levels were less than those recommended in the "Manitoba Air Quality Objectives."

**Liquid Effluent Emissions**

Mr. Arvidson stated that water for process and domestic applications would be obtained from ground water sources which have been determined to be of sufficient volume to supply pilot plant needs without jeopardizing supplies for other groundwater users in the area. Domestic uses are predicted to require a maximum rate of 1.6 L/s (21 i.g.p.m.). The sanitary waste water

would be held in approved septic tank holding facilities and would be removed periodically for treatment at the Town of Selkirk Wastewater Treatment Facility.

Process water used in the proposed facility would be restricted to the cooling tower operation which would employ a closed pipe system. The closed system would have no contact with by-products or raw materials used in the process. The closed loop system would be charged with water from a well located on the site. During warm weather months, (approximately May through October) a spray of cooling water onto piping would be used to supplement the cooling process through evaporative cooling. It is projected that the spray water would require treatment to prevent scaling. Blow down of the spray water to the Red River would be required in an amount of 0.2 L/s (2.5 i.g.p.m.). This volume is small relative to the corresponding warm weather Red River flow. The composition of the blowdown and the dilution that would occur should result in no measurable effect on the River.

**Solid Wastes**

Solid wastes from the production process will include tars, carbon, and silica dust captured in the plant's exhaust air and in the gas cleaning system. Carbon and silica dust captured in the plant may be recycled into the process as development of the process proceeds.

Glass slag from the silicon purification stage of the process will also be a waste product. The slag will be transported to a local landfill site registered under Environment Act Regulations. This by-product has been successfully marketed in other locations for construction applications; however, the relatively low slag production rate of 0.75 $m^3/d$ (1 $yd^3/d$) estimated for this facility does not make this alternative possible at this time.

**Contingency Planning**

Automated emergency shutdown mechanisms have been incorporated into the design of the proposed plant. The installation of fire extinguishers and fire hoses (as well as access to municipal fire fighting forces) would support these measures. In case of injury, local hospitals and ambulance service are available in the Town of Selkirk. Accidental releases would be dealt with as required on an individual basis. The emergency venting of carbon monoxide would be non-typical to the plant operation and would be rectified immediately or the process would be shut down. The expected duration of any emergency venting would be no longer than 15 minutes. In the event of any transportation emergency, local authorities would be advised.

Materials used in support of the main facility such as propane, acetylene, and other compressed gases would be handled as required under Manitoba Regulation 282/87. Oxygen, used in the process and in the maintenance shop would have to be dealt with in accordance with Manitoba regulations.

**Economic Impact**

Employment projections estimate the hiring of 22 support staff from the local workforce with 5 experienced technical staff being transferred from the United States. The total plant operation workforce is expected to be 27 for the duration of plant operation. The plant construction work force would vary as required. The construction cost will be $13.5 million with operating costs estimated at $10.2 million. Total direct and indirect/induced employment generation for this project is estimated at 470 person years. The local income generation for the duration of the project, in terms of direct and indirect income, is estimated to be $15 million.

**Monitoring**

Meadow Materials proposed to monitor air, water and solid wastes as outlined in Table 5. This would ensure that the actual emissions fall within projected values and within Manitoba objectives and guidelines for various air pollutants.

**LOCAL PRESENTATIONS**

The Selkirk and District Environmental Organization (SDEO), representing approximately 100 residents of the communities of Selkirk and East Selkirk, presented a brief outlining their concerns regarding the Meadow Materials proposal. Their presentation was made by Anne Cyr, chairperson, Jane Fidler, recording secretary, and Greg Dewar, treasurer.

The SDEO brief raised a number of concerns and questions with respect to the Meadow Materials proposal and various regulations governing other aspects of the proposal. A main concern was the air emissions from the plant and the methods used in the estimation of the environmental impact of these emissions. The SDEO expressed concern about a perceived lack of analysis of the combined effects of the emissions from the proposed plant and the adjacent Selkirk Generating Station. The SDEO expressed a belief that there is a lack of concrete data with regard to pilot plant emissions and waste products. This was a concern, especially with regard to the potential impact of the cumulative emissions from the two adjacent facilities (the Manitoba Hydro power generating station and the proposed Meadow Materials plant).

- The alleged lack of information with regards to pilot plant emissions and waste production was believed by the SDEO to be because of the experimental nature of the facility. As a result, the SDEO regarded the projected emissions as being theoretical. The SDEO felt that the actual

# MONITORING

TABLE 5

Monitoring scheme suggested to validate predictions and ensure compliance to applicable regulations.

| ITEM | LOCATION | FREQUENCY | ELEMENTS |
|---|---|---|---|
| AIR | | | |
| | WITHIN PLANT | CONTINUOUS | CO |
| | PROCESS VENT | FREQUENT | NO2<br>SO2<br>PARTICULATE |
| | UPWIND & DOWNWIND | PERIODIC | NO2<br>SO2<br>PARTICULATE |
| | EXHAUST OF FILTRATION | PERIODIC | PARTICULATE |
| | AROUND PLANT | N/A | NOISE |
| WATER | WELL WATER | QUARTERLY | GENERAL EVALUATION |
| | SANITARY | CONTINUOUS | VOLUME SHIPPED |
| | BLOWDOWN WATER | PERIODIC<br>CONTINUOUS<br>CONTINUOUS | WATER ANALYSIS<br>TREATMENT VOLUME<br>VOLUME |
| SOLID WASTES | | INITIAL<br>CONTINUOUS | CHARACTERISTICS<br>WEIGHT AND VOLUME |

emissions may not conform to computer modeling projections and might actually exceed the air quality criteria currently employed for the Province of Manitoba. The emissions which are of greatest concern are: sulfur dioxide (acid rain), nitrogen dioxide (vegetation damage), carbon monoxide and suspended particulates (human health concerns).

The potential impact on the water table of the area, the quality of the liquid effluents that would be released into the Red River, and the disposal of sanitary wastewater were questioned. There was also concern about the levels of hardness and the temperature of discharge water entering the Red River as it was feared that both factors could be detrimental to the aquatic ecology of the river. In addition, the Town of Selkirk occasionally relies on the Red River as a supplementary source of drinking water. There was a concern that plant effluent could negatively impact the quality of the Town's drinking water.

The SDEO report stated that the production of waste material is a necessary part of the process but in the case of the Meadow Materials proposal the nature and volume of waste is not specifically known due to the proprietary nature of the pilot plant. The SDEO was, therefore, concerned that Meadow Materials should fully disclose specific data concerning waste production as soon as it becomes available. The landfill sites capable of handling the waste in the area should be designated. Should no appropriate landfills be available, then it should be the responsibility of Meadow Materials to either locate appropriate facilities for the disposal of wastes or develop the necessary facilities themselves.

The SDEO stated that the transportation of goods, hazardous or not, should be restricted to routes capable of handling the goods in such a way as to minimize the potential threat to the residents of the area. Load limits for the route should be established and strictly enforced to ensure that deterioration of the roads do not occur.

Emergency situation planning should be undertaken by Meadow Materials. Full disclosure of any hazardous materials should be made to local officials so that emergency response teams will be able to immediately assess the severity of any emergency involving any hazardous materials on the site.

The SDEO would like to see a buffer zone established around the plant site for the protection of those residents whose property borders the site. Upon closure of the proposed plant and the dismantling of the facility, the SDEO recommends that Meadow Materials be held responsible for returning the site to it's original state.

The SDEO is not opposed to the development of new technologies. The development of the new proposal should, however, be carefully monitored to ensure maximum environmental protection. Monitoring costs should be covered by Meadow Materials with all results available for public scrutiny.

**Searle Greenhouses Ltd.**

Searle Greenhouses Ltd., is an East Selkirk agricultural firm involved in the production of outdoor garden and indoor ornamental plants. It's 14 greenhouses are located east of the proposed site and cover in excess of 0.5 hectare (one acre) of production space, generating in excess of $1 million in annual sales. The Searle Greenhouses Ltd., submission was presented by Mr. Larry Smith, vice-president and general manager.

Searle Greenhouses Ltd., agrees with Meadow Materials that the site for the proposed facility should be well removed from any environmentally sensitive facility or development; however, Mr. Smith expressed concern that the site selected for the proposed facility may not be sufficiently removed from their operation to ensure that the Meadow Material facility operation will not have detrimental impacts upon the greenhouse operation. Mr. Searle's analysis of the impact of the various emission gases, as projected by Meadow

Materials, has suggested to him that the production levels of these gases could be detrimental to greenhouse operation. The most significant to the greenhouse plants and, therefore, the gas of primary concern was identified as nitrogen dioxide.

Searle Greenhouses Ltd. expressed concerns about the predicted level of emissions and the associated impact upon the surrounding facilities and developments. The computer modeling, upon which Meadow Materials based it's Environmental Impact Assessment, is an acceptable method; however, the use of theoretical emission calculations together with what were felt to be out-of-date data from the Manitoba Hydro generating station, was not acceptable. The computer modeling predictions were not believed to provide acceptable proof that Searle Greenhouses Ltd. would not be deterimentally affected. Mr. Smith contended that the actual impact could only be determined through monitoring of emissions after the pilot plant has become operational.

The monitoring of gas effluent, as suggested by Meadow Materials, was not seen by Mr. Smith as being acceptable due to the lack of comparative background data. Monitoring programs should involve pre-operational air quality testing as part of the monitoring program. This would ensure that baseline data would be available for accurate comparison and assessment of the effects of the Meadows Materials plant emission. Furthermore, Searle Greenhouses Ltd.,an environmentally sensitive facility, should be a sampling location for any future monitoring program.

**The Environment Department**

Mr. Larry Strachan, Chief of Environmental Control Programs, of the Manitoba Environment Department, described the departmental review of the proposal and the Environmental Impact Assessment. The proposal was received by the Environment Department, October 2, 1989. Copies of the proposal were then placed in the public registries, circulated for interdepartmental review,

and advertised in appropriate newspapers. Guidelines for the preparation of the Environmental Impact Assessment were prepared and submitted to the Applicant, on November 27, 1989.

A report entitled, "Environmental Impact Assessment for the Silicon Products Pilot Plant" was received by the department, April 9, 1990 and distributed for inter-departmental review, April 12, 1990. A public notice of receipt was also published in the appropriate newspapers. Members of the public interested in reviewing the Environmental Impact Assessment were provided with copies upon request.

Public comments on the proposal and the Environmental Impact Assessment were received from Mrs. D. Doersam, Searle Greenhouses Ltd., (Mr. Larry Smith), the SDEO, (Ms. Anne Cyr), and the Arklie family. Comments focused upon concerns about emissions from the proposed facility, potential health risks and the detrimental effects of emissions on existing facilities and developments.

Provincial comments on the proposal and the Environmental Impact Assessment were received from: The Resources Allocation Working Group - Natural Resources, Manitoba Highways, Municipal Planning Branch, Mines Branch, Historic Resources Branch and Environmental Health Services. Comments were also received from the following Environment Department Sections: Water Pollution Control, Terrestrial Standards and Studies, Air Pollution Control, Inspection Services, Air Standards and Studies, and Water Standards and Studies. Deficiency statements were prepared based upon interdepartmental inputs and were filed with the Applicant on April 10, 1989, May 4, June 6 and June 26, 1990. Responses to these deficiency statements were received from the Applicant on May 23 and June 8, 1990. No official response had been received regarding the June 26th deficiency statement prior to the hearing date. All related correspondence was referred to the Clean Environment Commission.

Mr. Strachan stated that appropriate limits, terms, and conditions should be established in a licence to protect the receiving environment. In addition to the suggested restrictions on emissions, the Environment Department recommended that monitoring of the plant emissions and the surrounding area should also be considered on a periodic basis to verify design and predicted levels. A pre-operational air quality survey was also endorsed.

The proposal as filed by the Applicant constitutes a proposal under the meaning of the Federal EARP Guidelines and thus required an independent screening at the federal level. This screening has concluded that no significant impacts which would require a full EARP are evident and therefore, the Provincial approval process will take precedence.

**CORRESPONDENCE FOLLOWING THE HEARING**

Prior to the termination of the hearing, the Clean Environment Commission requested that the Environment Department respond by written submission to the substantial number of questions raised by the SDEO in their hearing presentation. Without prior notice of the presentation, many of the questions could not have been addressed on the night of the hearing, while others had already been answered. Still other questions in the presentation invoked response from Municipal or Provincial authorities not present at the hearing.

Subsequently to the hearing in response to the Commission's request, Mr. Arvidson, of Meadow Materials, submitted a brief to the Environment Department, dated August 2, 1990. This brief,along with the response of Mr. Strachan of the Environment Department, was submitted to the Clean Environment Commission, August 7, 1990. The entire response was forwarded to Ms. Cyr, chairperson of the SDEO for comment.

**Meadow Materials Response, August 2, 1990**

In addressing the questions raised by the SDEO, Mr. Arvidson stated that the projected air emission levels presented at the hearing had been adjusted to include the combined emissions of the proposed plant and the Selkirk Generating Station. The levels indicated that there would be no adverse cumulative effects as the result of the combined emissions from the two plants.

Concerns regarding wastewater quality and the potential impacts of wastewater discharge on downstream users of the Red River were addressed during the hearing. Mr. Arvidson further stated that the levels of contaminants would not exceed the Manitoba Surface Water Quality Objectives and so would have no significant negative impact upon aquatic life or downstream uses.

Mr. Arvidson stated that many questions raised by the SDEO involved municipal jurisdiction. Concerns regarding re-zoning and planning restrictions were felt by Mr. Arvidson to be beyond his domain of comment. Other concerns involving provincial regulations and their enforcement were also seen to be beyond his field of responsibility.

**Environment Department Response, August 7, 1990**

Mr. Strachan stated that the combined emissions of the Selkirk Generating Station and the proposed facility have been considered when assessing the impact of the proposed pilot plant. Futhermore, the Environment Department is satisfied with the review which was completed for the Environmental Impact Assessment.

Mr. Strachan provided Ms. Cyr with a copy of the report on "Air Quality and Emissions Assessment of the Selkirk Generating Station". A copy of "*Objectives and Guidelines for Various Air Pollutants* Ambient Air Criteria", and "Criteria for National Air Quality Objectives" were also given to Mrs. Cyr for review.

Mr. Strachan advised that the licence would be enforced by the Environment Department and that waste disposal is regulated as part of the Environment Act.

**Selkirk and District Environmental Organization Response-August 17, 1990.**

In response to the comments of Mr. Strachan and Mr. Arvidson, Ms. Cyr, chairperson of the SDEO replied to the Commission with further comments. The reply by Ms. Cyr stated that the SDEO believes that the Selkirk Generating Station has operated on a more continual basis than indicated by Mr. Strachan or Mr. Arvidson. In addition, the response received from Mr. Arvidson and Mr. Strachan did not adequately address the issue of carbon monoxide emissions or the effects of extreme weather conditions on the gaseous emissions.

The response from Ms. Cyr further indicated that programs should be implemented which would monitor the emissions from the proposed pilot facility and the Selkirk Generating Station. In addition, the SDEO would like to see a policy adopted which would require the notification of residents in the event that emissions from either facility were to result in an exceedance of the Manitoba Air Quality Objectives & Guidelines.

**Environment Department Response-August 21, 1990.**

Mr. Strachan responded to Ms. Cyr's comments of August 17, 1990.

He explained that the Selkirk Generating Station is designed to maximize the combustion of fuel (coal) combusted. This is accomplished by burning coal in the presence of oxygen, maximizing energy output and effectively eliminating the formation of carbon monoxide. Carbon monoxide emissions from the station are negligible. Other emissions of sulfur dioxide and nitrogen dioxide result in ambient air quality well below the "desirable levels" for these gases even when coupled to the output from the proposed silicon facility. There would be no adverse effects from these gases on vegetation or public health.

## DISCUSSION

The Dow Corning Silicon Energy Systems Ltd. proposed pilot plant is designed as a short term research and development facility with the basic purpose of developing technical and economic parameters for the future production of silicon metal on a commercial basis using a closed plasma furnace. The overall object of the project is the development of a system of silicon metal production which lowers the production costs through the improvement of the manufacturing process and the reduction and recycling of waste materials. It is the aim of the proposal to reduce the waste and by-product component of the process to maximize efficiency and thereby make the process economically feasible in the current North American industrial market. Should feasible technical and economic parameters be developed to warrant the design of a larger full scale production facility a new proposal would have to be developed. The new proposal would be required to undergo a public notification and review process under the Environment Act.

### The Site

The proposed site of the plant is in an area which is zoned industrial. The site is buffered 300-500 m from individual homes and 1 km from residential subdivisions and, in general, the site seems to be a suitable one for the proposed development.

Adherence to local bylaws and planning schemes for the area is required. A conditional use permit for the site was applied for and obtained by the applicant from the Municipality of St. Clements. Under the conditional use permit the site must be used as an industrial site which complies with the current planning scheme for the area. A buffer zone, of 300 - 500 m from individual homes and 1km from residential subdivisions, would also be required as part of the conditions governing the site use.

**Air Emissions**

The major concern expressed with regard to the proposal is the potential emissions to the atmosphere from the pilot plant and the effects of the emissions on the surrounding community. Searle Greenhouses Ltd. is located within 1.6 km of the proposed site to the east and the owners have expressed concerns about the potential negative impact of some emissions on the greenhouse operation. Residents in the area, represented by the SDEO, have also expressed concerns about the potential emissions and the effects of these emissions on the health of area residents.

At the hearing, concerns were expressed that predicted emissions are modeled, and that actual emissions will only be known during operation of the facility when monitoring of plant emissions takes place; however, a full production scenario has been utilized in the calculation and prediction of emissions. Furthermore, their dispersion and input has been modeled using the best available atmospheric data. For the purposes of the proposal, projected emission values were prepared based upon worst case conditions and known process and raw material parameters. The closed process furnace used in the proposed pilot plant allows for accurate predictions of emissions as the closed process does not allow for escape of any emission from the production process except through the process stack.

The main air emissions, sulfur dioxide, carbon monoxide dioxide, and nitrogen dioxide are end product emission gases with different associated potential environmental effects. While each has associated risks there are acceptable atmospheric levels of each gas included in the Manitoba Objectives and Guidelines for Various Air Pollutants.

## Sulfur Dioxide

Under the Manitoba Air Quality Objectives, sulfur dioxide emissions are projected to be below the "maximum desirable" levels for sulfur dioxide even with the addition of background levels during those periods when the Selkirk generating station is in operation.

Predicted values for the maximum levels of sulfur dioxide are well below provincial objectives, and therefore, no adverse effects to vegetation or public health should result from the sulfur dioxide emissions.

## Nitrogen Dioxide

Nitrogen dioxide can also be toxic to plants in sufficiently high concentrations and Searle Greenhouses Ltd. raised concerns about the emission of this gas. As with sulfur dioxide, nitrogen dioxide emission was predicted using worst case conditions and dispersion modeling. At the Searle location, the predicted levels of nitrogen dioxide are well below the provincial air quality objectives. Including both the predicted silicon plant emission and that of the generating station, nitrogen dioxide levels are expected to be much less than those specified in the Manitoba Air Quality Objectives. At the predicted levels there is no risk to human health or to vegetation.

## Carbon Monoxide

Carbon monoxide, the major process gas, is not emitted directly to the atmosphere except under emergency venting or failure of emission stack combustion. The combustion of carbon monoxide during normal stack operation results in the conversion of carbon monoxide to carbon dioxide, a common atmospheric gas. The possible failure of the combustion stack and subsequent emergency venting of carbon monoxide could result in ambient levels of the gas

in excess of the maximum desirable level concentrations. The levels predicted however were below the "maximum acceptable" level. For the purpose of the Environmental Impact Assessment, the worst case condition of emergency venting was used to predict maximum ambient levels of carbon monoxide. The emergency venting of process gases is not a normal event and the expected duration of such an event is a maximum of 15 minutes.

**Suspended Particulates**

Suspended particulates will be produced in the manufacturing process. The predicted levels of suspended particulates are also included in the Manitoba Air Quality Objectives. The predicted level of suspended particulate matter from the proposed plant is well below the maximum acceptable 24 hour average concentration specified in the Manitoba Air Quality Objectives. Even in the unusual event of ignition stack failure, and direct process venting, the estimated level of suspended particulates emitted would still be well below the Manitoba air quality objectives even when combined with background levels, primarily resulting from the operation of the power station. In this regard, it should be noted that Manitoba Hydro plans to install an electrostatic precipitator in its generating station within the next few years and this will reduce particulate emissions from this source to a significant degree.

Suspended particles will also be generated through the handling of raw materials and when crushing the hardened silicon metal casts for shipping. The design of the facility includes exhaust and filter systems designed to capture fugitive particles resulting from material handling.

**Liquid Emissions**

Liquid emissions from the proposed facility would be limited due to the nature of the proposed industrial process, requiring water only for a closed loop cooling system, with a very limited blowdown discharge from a cooling spray system to the Red River. Sanitary wastewater is being collected and removed to the Town of Selkirk wastewater treatment facility.

**Solid Waste**

Solid process wastes would include a glass like slag, tars, carbons and silica dust captured in the plant and process cooling filtration systems. The majority of this material would be non-hazardous in nature and so can be disposed of in regulated disposal sites in the area. Any waste that is found to be of a hazardous nature would have to be disposed of in accordance with regulations under the Dangerous Goods Handling and Transportaion Act.

As the proposed plant is designed to reuse as much captured material as possible the carbon and silica captured in the process filtration system could be recycled in the process. The glass slag also has the potential for use as it has been successfully marketed as a construction material in other localities. Due to the relatively small volume of this material being produced it would be unlikely that the slag would be marketed.

## CONCLUSIONS

The Commission concludes that the evidence presented identifies the principal environmental concern, related to the proposed Meadow Materials operation, to be the emission of air pollutants. The proponent has taken measures to mitigate any water pollution impacts by means of a closed loop cooling system that results in a minor discharge to the Red River during much of the open water season. Sanitary wastes are to be removed to the town of Selkirk Water Pollution Control Centre for treatment and disposal. Odors and noise were not identified to be a potential problem with the operation. Some concerns were expressed by intervenors concerning transportation of goods and solid waste disposal; however, these matters come under the purview of other government departments and the municipal government. Solid waste must be removed to a waste disposal grounds registered for the purpose under the Environment Act.

In connection with the emissions to the atmosphere from the Meadow Materials operation, contaminants include sulphur dioxide, nitrogen dioxide, carbon monoxide and suspended particulate matter. All of the contaminants are less than the maximum desirable/acceptable level concentrations prescribed in the "Manitoba Objectives and Guidelines for Various Air Pollutants Air Ambient Criteria." These guideline concentrations were developed to protect the most sensitive receptor from damage and include suitable built-in factors of safety.

In the analysis of the emissions, the existing background levels were also considered including emissions from the Manitoba Hydro electric power generating station, located adjacent to the proposed Meadow Materials plant. With regard to questions raised about future operation of the power station, Manitoba hydro has identified that the power station is planned to continue to be operated on a stand-by basis and no greater frequency of operation is planned at the present time. There are no plans to increase the power output capacity beyond the present capability of the two existing generators. Carbon

monoxide is not an air emission from the operation of the power station. Modernization plans for retrofitting of the power station to extend its useful life over the next several years include the installation of an electrostatic precipitator, which will substantially reduce particulate emissions from the generating station.

On a short term basis, during any emergency venting of the furnace gases which might become necessary, carbon monoxide concentrations would exceed the "desirable" level concentrations but would be less than the "acceptable" level concentration established in the Guidelines. It is understood that this would occur only infrequently and for an expected duration of less than 15 minutes during such non-typical venting occurrences.

The Commission believes that the most important licensing consideration is the monitoring of emissions.

Both intervenors at the hearing requested a pre-operational base line survey. The Environment Department representative concurred that the establishment of some base line data would be reasonable. The proponent in his environmental impact assessment, expressed the opinion that the procurement of additional general baseline data by a pre-operational ambient air monitoring survey would not be necessary or effective.

In the absence of specific recommendations on monitoring, the Commission concludes that the Environment Department should establish a monitoring schedule based upon their extensive experience, that includes measurement of the contaminants of concern at both the source and at the maximum points of impingment downwind from the site. A pre-operational base line survey should be part of the Environment Department's consideration in determining an appropriate monitoring regime.

**RECOMMENDATIONS:**

The Commission recommends that the Meadow Materials Project should be licensed under the Environment Act with the following limits, terms, and conditions being included in such a license:

1) The Applicant shall limit the emission of the following contaminants from the said operation to such an extent that downwind ground level concentrations of the contaminants, in conjunction with those from the operation of the Selkirk Generating Station, are not in excess of the following limits:

| Contaminant | Period of Time Contaminant is measured | Concentration (per cubic metre) |
|---|---|---|
| Carbon Monoxide | 1-hr average | 35 milligrams |
| Nitrogen Dioxide | 1-hr average | 400 micrograms |
| | 24-hr average | 200 micrograms |
| | Annual Arithmetic Mean | 60 micrograms |
| Sulphur Dioxide | 1-hr average | 450 micrograms |
| | 24-hr average | 150 micrograms |
| | Annual Arithmetic Means | 30 micrograms |
| Suspended Particulate Matter | 24-hour average | 120 micrograms |
| | Annual Geometric Mean | 60 micrograms |

2) The Applicant shall notify the Director of any significant increases in either the quantity of blowdown from the cooling water spray system or increases in the emission characteristics of the blowdown, using as the criteria the information provided by the applicant in his Environmental Impact Assessment.

3) The Applicant shall take whatever measures are feasible to limit the occurrence of the emergency venting of the furnace and on these occasions the duration of the venting shall not exceed 15 minutes in duration.

4) The Applicant shall at all times maintain a high standard of equipment maintenance and good housekeeping practices consistent with meeting the limits, terms and conditions prescribed.

5) The Applicant shall ensure that adequate stack sampling facilities are installed in a manner satisfactory to the Director of the Environment Department.

6) The Applicant shall undertake a source monitoring program to determine levels of carbon monoxide, nitrogen dioxide, sulphur dioxide and suspended particulate matter emissions in a manner and at a frequency suitable to the Director.

7) The Applicant shall at locations and in a manner and with such frequency acceptable to the Director, conduct an ambient air monitoring program to monitor carbon monoxide, nitrogen dioxide, sulphur dioxide and suspended particulate matter.

8) The Applicant shall operate a solid waste disposal program in accordance with MR 98/88R under the Environment Act.

9) The Applicant shall handle and store gasoline and associated products in accordance with MR 97/88R under the Environment Act.

10) The Applicant shall handle, store and dispense any dangerous goods in accordance with the Dangerous Goods Handling and Transportation Act.

11) The Applicant shall notify the Director immediately of any non-typical emergency venting procedure.